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Spatially-degraded adhesive anchors under material uncertainty

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Abstract

The classic problem of stress transfer in a cylinder through shear to a surrounding medium, is analyzed here in the context of pullout of an anchor under material uncertainty. Assuming a log-normal distribution for the random shear stiffness field of the adhesive, the stochastic differential equation (SDE) is formulated for spatially-tailored/degraded adhesive anchors. The stochastic shear stress distribution in the adhesive is presented for various embedment lengths and adhesive thicknesses clearly demarcating the regime over which failure would initiate. The stochastic variation of maximum shear stress of the adhesive as a function of embedment length and adhesive thickness is also presented. It is observed that the mean maximum shear stresses in the degraded adhesive for both fixed and free embedded-end cases converge and the influence of boundary condition at the embedded-end on shear stress field disappears as the embedment length is increased. For the parameters considered here, about 45% longer embedment length is required compared to an intact bondline for shear-dominated load transfer, suggesting that the

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